

Claims

1. A production line having a plurality of successive stages for construction of a product comprising at least one layer on a substrate, and routers for transferring partly constructed products between the stages such that each stage receives a respective predefined partly constructed product as its input, the production line comprising:

a predetermined reflected light intensity spectrum for at least one stage representing the respective predefined part construction for the stage,

a reflected light intensity spectrum deriver located at said at least one stage operable to obtain reflected light intensity spectra of incoming partly constructed product, and

a comparator, for comparing said obtained reflected light intensity spectra with said predetermined reflected light intensity spectrum, to determine whether said incoming partly constructed products correspond with said respective predefined part construction for the stage.

2. A production line according to claim 1, further comprising a routing error indicator operatively associated with said comparator for indicating a routing error when said spectra do not match.

3. A production line according to claim 2, comprising a production interruption mechanism operatively associated with said routing error indicator for interruption of operation of said production line in the event of indication of a routing error.

4. A production line according to claim 1, wherein each stage comprises a plurality of production tools operating in parallel.

5. A production line according to claim 4, wherein each stage comprises a reflected light intensity spectrum deriver and has a predetermined intensity spectrum.

6. A production line according to claim 5, wherein said comparator is further operable to compare said obtained reflected light intensity spectrum with predetermined spectra of at least one other stage to reroute said product to said other stage if said spectra match.

7. A production line according to claim 5, wherein said production line is a semiconductor wafer production line for producing a layered semiconductor wafer product.

8. A production line according to claim 1, wherein said intensity spectrum deriver comprises

an illuminator for irradiating a part product at at least one point thereof with a multiple wavelength radiation source,

an intensity detector for detecting intensities within reflections of said source from said point,

an analyzer operatively associated with said intensity detector for analyzing said intensities in terms of wavelength and converting said analyzed intensities spectrum into a frequency spectrum thereof, and

a layer property determiner for determining, from said frequency spectrum, layer properties of layers on said part product.

9. A production line according to claim 8, wherein said property is one of a group comprising a thickness and a refractive index.

10. A production line according to claim 8, wherein said part product includes at least one at least partly transparent layer and said reflections include reflections from an upper and a lower surface of said at least partly transparent layer.

11. A production line according to claim 8, wherein said analyzer comprises a Fourier transform calculator for producing said frequency spectrum by Fourier transformation of said analyzed intensity spectrum.

12. A tool guard for restricting input to a production tool for carrying out a stage in the production of a layered product, the tool guard comprising:

a predetermined intensity spectrum representing an expected part construction for the stage,

an intensity spectrum deriver located at said tool operable to obtain an intensity spectrum of an incoming partly constructed product, and

a comparator, for comparing said obtained intensity spectrum with said predetermined intensity spectrum, to determine whether said incoming partly constructed product corresponds with said respective predefined part construction for the stage.

13. A tool guard according to claim 12, further comprising a routing error indicator operatively associated with said comparator for indicating a routing error when said spectra do not match.

14. A tool guard according to claim 13, comprising a production interruption mechanism operatively associated with said routing error indicator

for interruption of operation of said tool in the event of indication of a routing error.

15. A tool guard according to claim 12, wherein said tool is a semiconductor wafer production tool for use in a production line producing a layered semiconductor wafer product.

16. A tool guard according to claim 12, wherein said intensity spectrum deriver comprises

an illuminator for irradiating a part product at at least one point thereof with a multiple wavelength radiation source,

an intensity detector for detecting intensities within reflections of said source from said point,

an analyzer operatively associated with said intensity detector for analyzing said intensities in terms of wavelength and converting said analyzed intensities into a frequency spectrum of the intensities, and

a layer property determiner for determining, from said frequency spectrum, layer properties of layers on said part product.

17. A tool guard according to claim 16, wherein said property is one of a group comprising a thickness and a refractive index.

18. A tool guard according to claim 16, wherein said part product includes at least one at least partly transparent layer and said reflections include reflections from an upper and a lower surface of said at least partly transparent layer.

19. A tool guard according to claim 16, wherein said analyzer comprises a Fourier transform calculator for producing said frequency spectrum by Fourier transform of said analyzed intensities.

20. A production line router for routing intermediate inputs around a multiple stage production line, the intermediate inputs comprising substrates with at least one superimposed layer, the router comprising:

predetermined intensity spectra for each of a plurality of said stages representing a respective intermediate construction for the stage,

at least one intensity spectrum deriver located within said production line for obtaining intensity spectra of intermediate inputs,

a comparator, for obtaining a closest match between said obtained intensity spectrum and any of said predetermined spectra, said router being operable to route said intermediate input to a stage corresponding to said closest matching spectrum.

21. A production line router according to claim 20, wherein each stage comprises a plurality of production tools operating in parallel.

22. A production line router according to claim 21, wherein each stage comprises an intensity spectrum deriver and has a predetermined intensity spectrum.

23. A production line router according to claim 20, wherein said production line is a semiconductor wafer production line for producing a layered semiconductor wafer product.

24. A production line router according to claim 20, wherein said intensity spectrum deriver comprises

an illuminator for irradiating a part product at at least one point thereof with a multiple wavelength radiation source,

an intensity detector for detecting intensities within reflections of said source from said point,

an analyzer operatively associated with said intensity detector for analyzing said intensities in terms of wavelength and converting said analyzed intensities into a frequency spectrum of the intensities spectrum, and

a layer property determiner for determining, from said spectrum, layer properties of layers on said part product.

25. A production line router according to claim 24, wherein said property is one of a group comprising a thickness and a refractive index.

26. A production line router according to claim 24, wherein said intermediate input includes at least one at least partly transparent layer and said reflections include reflections from an upper and a lower surface of said at least partly transparent layer.

27. A production line according to claim 24, wherein said analyzer comprises a Fourier transform calculator for producing said spectrum by Fourier transform of said analyzed intensities.

28. A wafer production history determiner for determining the production history of a semiconductor wafer product, the determiner comprising:

a plurality of predetermined intensity spectra for semiconductor wafer products having completed respective stages of a multiple stage semiconductor wafer production process.

an intensity spectrum deriver for obtaining an intensity spectrum of an incoming semiconductor wafer product, and

a comparator, for comparing said obtained intensity spectrum with each of said predetermined intensity spectra, to determine a closest match between said obtained spectrum and one of said predetermined spectra, said determiner inferring said production history as including the respective completed stage corresponding to said closest match predetermined spectrum.

29. The use of a spectrum obtained by reflecting multiple wavelength light from a plurality of points on a layered product, to determine a production history of said layered product.

30. In a production line having a plurality of successive stages for construction of a product comprising at least one at least semi-transparent layer on a substrate, and routers for transferring partly constructed product between the stages such that each stage receives a respective predefined partly constructed product as its input, and having a predetermined intensity spectrum associated with at least one stage representing the respective part construction for the stage, a method comprising:

obtaining intensity spectra of partly constructed products incoming to said stage, and

comparing said obtained intensity spectra with said predetermined intensity spectrum, and thereby determining whether said incoming partly constructed product corresponds with said respective predefined part construction for the respective stage.

31. A method according to claim 30, further comprising indicating a routing error when said spectra do not match.

32. A method according to claim 31, comprising interrupting operation of said production line in the event of indication of a routing error.

33. A method according to claim 30, wherein each stage comprises a plurality of production tools operating in parallel.

34. A method according to claim 33, comprising obtaining intensity spectra for incoming partly constructed products to each stage, each said stage having a predetermined intensity spectrum.

35. A method according to claim 34, comprising comparing said obtained intensity spectrum with predetermined spectra of at least one other stage to reroute said product to said other stage if said spectra match.

36. A method according to claim 30, wherein said production line is a semiconductor wafer production line for producing a layered semiconductor wafer product.

37. A method according to claim 30, wherein obtaining said intensity spectrum comprises

irradiating a part product at at least one point thereof with a multiple wavelength radiation source,

detecting intensities within reflections of said source from said point,

analyzing said intensities in terms of wavelength, thereby to produce a spectrum of intensities at respective wavelengths,

converting said spectrum of intensities into a frequency spectrum, and

determining, from said frequency spectrum, layer properties of layers on said part product.

38. A method according to claim 37, wherein said property is one of a group comprising a thickness and a refractive index.

39. A method according to claim 37, wherein said part product includes at least one at least partly transparent layer and said reflections include reflections from an upper and a lower surface of said at least partly transparent layer.

40. A production line according to claim 37, wherein said converting comprises producing said spectrum by Fourier transform of said analyzed intensities.